RECOMMENDED SAFETY STANDARDS FOR SURFACE AUGER MINING

* * * * * * * * * * **Information Circular 7845**

UNITED STATES DEPARTMENT OF THE INTERIOR
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BUREAU OF MINES
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SUMMARY AND INTRODUCTION

The method of using large-diameter augers to recover coal was introduced to the mining industry about the end of World War II, and production of bituminous coal with augers has increased steadily to an estimated 7 million tons, or approximately 1.4 percent of the total mined in 1956. Although auger mining has proved to be a reliable and economical method of mining coal, a number of unfortunate fatal accidents have been experienced; consequently the need for these recommended safety standards is indicated for this comparatively new method of coal mining.

As mining methods and equipment change from time to time and new hazards are introduced, these standards will be revised; therefore, questions or suggestions from the coal-mining industry will be welcomed and carefully considered.

ACKNOWLEDGMENTS

The Bureau of Mines expresses its appreciation to the officials and representatives of the cooperating coal-mining companies, the United Mine Workers of America, equipment manufacturers, and officials of various State-inspection agencies for courtesies and assistance extended to Bureau personnel during this study.

ACCIDENTS IN THE AUGER-MINING INDUSTRY

The Bureau of Mines has recorded several fatal accidents charged to the auger-mining industry, and the following five represent the nature of these occurrences:

(1) A workman died in January 1955 from injuries received when a portion of the highwall collapsed and crushed him against an auger section about to be connected to the auger train. (2) In July 1955 an employee was killed instantly by a rock slide soon after commencing the recovery of a narrow strip (13 feet) of coal between two auger holes. (3) On October 12, 1956, two men lost their lives by asphyxiation, and a third was temporarily overcome when attempting to rescue an employee who had entered a recently completed auger hole. (4) During the same month, a coal-dust and/or gas explosion at the face of an auger hole being drilled resulted in second- and third-degree burns to the four-man auger crew. (5) On June 12, 1957, a gas and/or coal-dust explosion occurred when an auger-machine operator entered an auger hole, immediately after its completion, with a lighted cigarette and articles for smoking. The explosion so severely injured the operator that he died the next day; it also inflicted second- and third-degree burns to three other men changing the bits on the cutterhead in front of the auger hole.

Other records describe squeezes in the augered area, collapse of the roof in auger holes, and failure of the pillars left between auger holes.

1/ Work on manuscript completed November 1957.

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The precautions recommended in this publication are designed to combat these and other hazardous conditions.

RECOMMENDED SAFETY STANDARDS FOR SURFACE AUGER MINING

1. Surface Structures

Tipple and Cleaning Plant

1.01 In dusty locations electric motors, switches, lighting fixtures, and controls should be enclosed by reasonably dusttight housings.2/

1.02 Structures should be kept reasonably free of coal-dust accumulations.

1.03 Where repairs are being made to the plant or where equipment or material is being used or transported overhead, proper scaffolding or proper overhead protection should be provided.

1.04 Welding or cutting with arc or flame should not be done in dusty atmospheres or dusty locations.2/

1.05 Fire-fighting apparatus should be readily available during welding or cutting operations with arc or flame, and the area should be thoroughly wetted.

Stairways, Ladders, Platforms, and Runways

1.06 Stairways, elevated platforms, floor openings, and elevated runways should be equipped with suitable handrails or guardrails and toeboards.

1.07 Permanent ladders more than 10 feet in height should be provided with back guards.

1.08 Platforms, stairways, and runways should be kept clear of stumbling and slipping hazards and maintained in good repair.

Housekeeping

1.09 Good housekeeping should be practiced in and around mine buildings and yards. Such practices include cleanliness, orderly storage of materials, and the removal of possible sources of injury, such as stumbling and slipping hazards, protruding nails, broken glass, and falling and rolling materials.

Illumination

1.10 Adequate illumination should be provided as needed in or on surface structures.

1.11 Surface paths and walks that are used by workmen in performing their work should be kept free of unnecessary obstructions and slipping and falling hazards and should be suitably illuminated when required to be used at night.

2/ Bituminous-coal mines only.

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2. Miscellaneous Surface Conditions

Surface Fire Prevention

2.01 Oil, grease, diesel fuel, gasoline, and similar flammable materials should be kept in closed containers, separated from other materials, so as not to create a fire hazard to nearby buildings, auger holes, or other mine openings. If oil, gasoline, or grease is stored in a building, the building or room in which it is stored should be of fireproof construction and well ventilated.

2.02 Oily rags, oily waste, and wastepaper should be kept in closed metal containers until removed for disposal.

2.03 Smoking or open lights should be prohibited in or around oil houses, explosives magazines, in or near auger holes, and at or near fuel-storage tanks or other places where they may cause a fire or explosion. Fires for warming or thawing should not be started in proximity to oil storage, equipment, or auger holes that can carry smoke into active underground workings.

2.04 Gasoline should be delivered to equipment only in safety containers.

2.05 Diesel fuel should be transported in containers equipped with safety valves.

2.06 Gasoline and diesel-fuel containers should not be opened near a source of ignition (welding, etc.)

3. Augering Coal

Location of Auger Holes, Highwall Inspection, and Records

3.01 Auger crews should carefully inspect the face of the highwall, 25 feet on both sides of the drilling site, before augering operations begin and frequently thereafter, and all loose material should be removed before any other work is done. Special precautions should be taken during intermittent freezing and thawing weather and periods of heavy rainfall. Drilling should not be done under an overhang.

3.02 When a crew is engaged in connecting or disconnecting auger sections under a highwall, a person should be stationed to observe the highwall for possible movement.

3.03 Auger mining should not be done in proximity to active underground workings unless the work is coordinated with the underground plan of workings. Auger holes should not be drilled so as to:

(a) Disrupt the ventilation systems of active underground mines.
(b) Create inundation hazards to active underground mines.
(c) Cause damage to the roof and ribs of active underground roadways.

3.04 Auger holes should not intersect underground mine workings known to contain or suspected to contain dangerous quantities of impounded water, except to dewater such areas under controlled conditions and then only after all necessary precautions have been taken to safeguard life and property.

3.05 When auger holes first penetrate abandoned or mined-out underground workings, and as frequently thereafter as these workings are penetrated, a qualified employee should determine, by recognized means of detection, whether or not methane or

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oxygen-deficient air is present or is being emitted in dangerous quantities. These inspections and findings should be recorded.

3.06 Auger-mining equipment should not be operated in the vicinity of auger holes emitting dangerous quantities of methane or oxygen-deficient air until the atmosphere has been rendered harmless.

3.07 Pillars between auger holes should be wide enough to support the overburden adequately.

3.08 The depth and direction of auger holes should be plotted on a map showing adjacent mined areas; the map should be kept up to date and made available to interested persons.

Auger Equipment and Operation

3.09 The operator should not leave the controls while the drill is being operated.

3.10 Persons should keep clear of the auger train while it is moving and should not pass under or over an auger train, except where suitable crossing facilities are provided.

3.11 Persons should keep clear of auger sections being swung into position.

3.12 Where practicable, no persons, including the auger-machine operator, should be in a direct line with the boreholes during mining operations in case explosive gas or dust is ignited by the auger striking sulfur.

Inspection and Examination of Auger Holes

3.13 Other persons should not enter an auger hole until a qualified employee has determined by recognized means of detection whether the air within the hole is of good quality and does not contain methane or is deficient in oxygen. The examiner should wear a lifeline that extends to the hands of a person on the surface.

3.14 Internal-combustion engines in the vicinity of auger holes should be stopped while auger holes are being inspected.

3.15 At least one permissible flame safety lamp, in proper working condition, or other approved device for determining methane and oxygen-deficient air, should be available at each auger machine for the use of qualified employees.

3.16 An employee competent to make gas tests should be on duty each shift while each auger machine is being operated.

3.17 Persons entering an auger hole should examine and test its walls for danger from falling materials. Any hazardous conditions found should be corrected immediately or before any other work is done; otherwise, the hole should be vacated and a suitable danger board placed across its entrance.

4. Haulage

Pit Haulage - Automotive Equipment and Operation

4.01 Trucks should be inspected each shift and maintained in safe operating condition.

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4.02 Trucks should be handled carefully and kept under control at all times. They should be provided with efficient headlights, taillights, windshield wipers, and warning devices.

4.03 Other than the operator, no person should ride on a truck unless authorized by the management, and no person should be permitted to ride on the running board of any truck or on top of a loaded truck.

4.04 Standard traffic rules and signals should be adopted, posted, and followed.

4.05 Truckdrivers should be seated when their trucks are moving.

4.06 Truckdrivers should sound a warning signal when approaching the augering equipment and should not attempt to pass the equipment until they receive the proper signal from the operator. Where pit conditions prevent an exchange of signals between truckdrivers and auger operators, a flagman should be on duty to give signals.

4.07 Truck roads should be maintained in good condition.

4.08 Truckdrivers should maintain safe distances between trucks at all times.

4.09 Wherever possible, truck roads from the pit to the surface should allow only one-way traffic, particularly if the road is on a steep grade. If this is impracticable, the road should be wide enough to accommodate the safe passage of trucks at all points, or definite turnouts and waiting points should be designated.

4.10 No person should be permitted to work on the chassis of a truck while its body is in a raised position until after the truck body has been securely blocked in position, preferably between the body and frame. The mechanical hoist mechanism should not be depended on to hold the truck body in a raised position.

4.11 A substantial bumping block to stop a truck from backing or a safety hook designed to engage the front axle should be provided at all places where a rear-dump truck discharges its load, unless the load is being dumped for spreading.

4.12 Trucks should not be operated in reverse unless the driver has a clear view of the area behind the truck or a person is assigned to direct movement of the truck. Warning signals should be given before trucks are backed.

5. Electricity

Transmission Lines

5.01 Overhead high-potential powerlines should be at least 15 feet above the ground, 20 feet above driveways and haulageways, and 28 feet above railroad tracks; they should be installed on insulators and supported and guarded to prevent contact with other circuits. When equipment must be moved under powerlines where clearance is questionable, such powerlines should be deenergized, or other precautions should be taken to prevent contact with such circuits.

5.02 Transmission lines should be protected against short circuits; if exposed to lightning, suitable lightning arresters should be installed to provide protection.

5.03 Electric wiring in buildings should be installed so as to minimize fire and contact hazards.

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5.04 Telephone lines on the same poles as high-voltage lines should be at least 4 feet below the high-voltage lines and be well insulated.

5.05 Telephones should be equipped with lightning arresters effectively grounded.

5.06 Power cables having exposed wires should not be used.

5.07 Where steel-armored cable is employed, spliceboxes should be used to make the armor continuous for grounding.

Transformer Stations

5.08 Transformers should be isolated by elevation (8 feet or more above the ground), enclosed in a transformer house, or surrounded by a suitable fence at least 6 feet high. If the enclosure or fence is of metal, it should be grounded effectively by a separate grounding medium, distinct from the lightning arrester or the transformer grounding system. The gate or door to the enclosure should be locked at all times unless authorized persons are present.

5.09 Transformers containing flammable oil and installed where they present a fire hazard (in or near combustible buildings or near explosives magazines or exposed coal beds) should be provided with means to drain to a safe location or to confine the oil if the transformer casing ruptures.

5.10 Suitable danger signs should be posted conspicuously at all transformer stations.

5.11 Transformer stations should be kept free of nonessential combustible materials and refuse.

Substations, Electrically Operated Pumps, and Compressors

5.12 Substations, pump stations, and compressor stations should be kept free of nonessential combustible materials and refuse.

5.13 Housings enclosing oil switchgear should be ventilated effectively.

Power Circuits

5.14 Power wires and cables should have adequate current-carrying capacity and, unless encased in metallic armor, should be guarded from mechanical injury.

5.15 Power wires and cables should be insulated adequately where they pass into or out of electrical compartments and where they cross other power wires and cables.

Grounding

5.16 Metallic sheaths, armors, and conduits enclosing power conductors should be electrically continuous throughout and should be grounded effectively.

5.17 Metallic frames, casings, and other enclosures of electric equipment that can become "alive" through failure of insulation or by contact with energized parts should be grounded effectively, or equivalent protection should be provided.

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5.18 In alternating-current power systems where the line-to-ground voltage exceeds 150 volts, the system should be grounded through a suitable impedance at the transformer station and a suitable neutral or ground conductor between the impedance and the electric equipment. A relay should be provided to trip the circuit if a ground fault occurs.

Circuit Breakers, Switches, and Switchboards

5.19 Automatic circuit-breaking devices or fuses of the correct type and capacity should be installed to protect all electric equipment and power circuits against excessive overload. Copper wires or other materials having high fusing temperatures should not be used as substitutes for properly designed fuses, and circuit-breaking devices should be maintained in good operating condition.

5.20 Operating controls, such as switches, starters, and switch buttons, should be so installed that they are readily accessible and can be operated without danger of contact with moving or live parts. Provision should be made for locking starting equipment in the "off" position to prevent accidental application of power.

5.21 Disconnecting switches or other acceptable circuit-opening devices should be installed in all branch circuits adjacent to main circuits and as near as practicable to the main circuits or power supply from which the branch circuit originates.

5.22 Electric equipment and circuits should be provided with switches or other controls of safe design, construction, and installation.

5.23 Dry wooden platforms, insulating mats, or other electrically nonconductive material should be kept in place at each switchboard, power-control switch, and stationary machinery where shock hazards exist.

5.24 Resistors or rheostats should be installed so as not to create a fire hazard and should be guarded adequately against personal contact.

5.25 Electric parts, such as switches, circuit breakers, rheostats, relays, and fuses, should be installed on switchboards or mounted on incombustible bases of slate or equivalent insulating material unless specifically designed for mounting on pipe framework or steel structures.

5.26 Switchboards should be located so that ample room will be provided between the switchboard and passageways or lanes of travel and should have an entrance at each end to permit authorized persons to inspect, adjust, or repair apparatus back of the board. Entrances to the rear of the switchboards should be guarded against entrance of unauthorized persons, unless the switchboards are in a building that is kept locked.

5.27 Switchboards should be well lighted for operations in the front and for repair and maintenance in the rear.

5.28 Rooms housing switchboards should not be used for storing combustible and nonessential materials and should be kept free of debris.

5.29 Suitable danger signs should be posted conspicuously at all high-potential switchboard installations.

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Trailing Cables

5.30 Trailing cables should be provided with means for safely disconnecting power from the cable.

5.31 Splices in trailing cables should be made in a workmanlike manner, mechanically strong, and well insulated.

5.32 Trailing cables should be protected against mechanical damage and, insofar as practicable, be out of mud or water.

5.33 Energized trailing cables carrying more than 440 volts should be handled with suitable insulated hooks, and those carrying 440 volts or less should be handled with rubber gloves or insulated hooks.

Electrical Inspections

5.34 Electric equipment and wiring should be inspected by a competent person at least once each week, and any dangerous condition found should be corrected. A report of such inspections should be available to interested persons.

5.35 Equipment and wiring should be repaired by a competent authorized person.

5.36 Power circuits and electric equipment should be deenergized before work is done on them; however, employees may, where necessary, repair energized, low-potential power wires if they wear insulated shoes and lineman's gloves.

6. Safeguards for Mechanical Equipment

Shop and Other Equipment

6.01 The following should be guarded adequately:

(a) Gears, sprockets, pulleys, fan blades, friction devices, and couplings with protruding bolts or nuts.
(b) Shafting and projecting shaft ends within 7 feet of floor or platform level.
(c) Belt, chain, or rope drives within 7 feet of floor or platform.
(d) Fly wheels extending more than 7 feet above the floor should be guarded to a height of at least 7 feet.
(e) Circular and band saws and planers.
(f) Repair pits: Guards should be kept in place when pits are not in use.
(g) Counterweights.

6.02 Machinery should not be repaired while it is in motion, nor should it be oiled while in motion except where safe, remote oiling devices are used.

6.03 A guard or safety device removed from any machine should be replaced before the machine is operated.

6.04 No person should be permitted to work under or repair equipment that is in a raised position until such equipment has been securely blocked in position. Hoist mechinisms should not be depended on to hold equipment in a raised position.

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6.05 Mechanically operated grinding wheels should be equipped with:

(a) Safety washers and tool rests.
(b) Substantial retaining hoods; hood openings should not expose more than a 90° sector of the wheel.
(c) Eyeshields, unless goggles are worn by the operators.

Augering Equipment

6.06 A heavy screen should be provided over auger machines, strong enough to prevent injuries to workmen by spalling material from the highwall, or the machine should be kept a safe distance from the highwall.

6.07 Auger machines should be equipped with a torque converter to slow the operation when hard drilling causes arcs and sparks or overheating of the cutter head.

6.08 The angle and setting of the bits should be maintained to permit clearance of not less than one-fourth inch between the drum and the auger hole to minimize friction and overheating.

6.09 Exhaust gases from internal-combustion engines should be conducted away from auger holes and the working area for the protection of the workmen and to prevent ignitions of gas or dust emanating from such holes.

6.10 Diesel exhausts should be equipped with mufflers to reduce noise and guarded where necessary to prevent burns.

6.11 Before idle shifts or off time, all augering equipment should be moved a safe distance from the highwall.

7. Miscellaneous Hazards

Illumination

7.01 Adequate illumination should be provided for men on the night shift. Only permissible electric cap lamps or flashlights should be used underground.

7.02 Equipment used on the night shift and the highwall should be well illuminated. Tractors should be equipped with efficient headlights.

7.03 Light bulbs on extension cables should be guarded adequately.

Abandoned Workings

7.04 Warning signs should be posted conspicuously at the entrances to abandoned auger operations and at strategic locations along the outcrop line where coal has been mined with augers.

7.05 Completed auger holes should be blocked with highwall spoil, piled to a minimum height of 1 foot above the coal bed and to within 1,000 feet of the active holes. Auger holes should be blocked before the operation is abandoned.

7.06 Combustible materials, dinner pails, or other supplies should not be stored in abandoned auger holes.

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7.07 Partitions of coal between auger holes should not be recovered by other methods of mining.

Protective Clothing

7.08 Protective hats should be worn where there is danger from falling objects.

7.09 Protective footwear should be worn by all persons while on duty around the mine where falling objects may cause injury.

7.10 Approved-type goggles or shields should be worn where there is a hazard from flying particles.

7.11 Welders and helpers should use proper shields or goggles to protect their eyes.

7.12 Protective gloves should be worn when handling material that may injure the hands; gloves with guantlet cuffs should not be worn around moving equipment.

7.13 Persons exposed to dust-, fume-, and mist-inhalation hazards should wear permissible respiratory equipment.

7.14 Persons should wear snug-fitting clothing while working around or near machinery.

Fire Protection

7.15 Adequate and suitable fire-fighting equipment should be provided at or on each piece of machinery and at or near each structure.

8. General Safety Conditions

Mine Accidents

8.01 Auger mine accidents resulting in the death of one or more persons should be reported immediately by the quickest available means to the nearest office of the Federal coal-mine inspector or other health and safety representative of the Federal Bureau of Mines.

8.02 Following an auger mine accident resulting in the death of one or more persons, the evidence surrounding such an occurrence should not be disturbed after bodies are recovered or injured persons rescued until an investigation by Federal coal-mine inspectors has been completed; however, enough wreckage or debris may be moved to allow continued general operation of the mine following fatalities.

Reporting Injuries, Production, and Employment

8.03 The management of each auger mine operation should keep an accurate record of all accidents at the mine that involve injury to an employee (lost-time and no-lost-time accidents). All accidents resulting in loss of time beyond the day of injury, with the required employment and production data, should be reported on Forms 6-1420 and 6-1420A to the Federal Bureau of Mines in accordance with instructions on such forms; any accident involving a fatality should be reported immediately to the Federal Bureau of Mines.

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Reporting Dangers

8.04 Any employee of an auger mine who discovers an unsafe condition at the mine should immediately report it to the proper persons.

First Aid and Medical Care

8.05 Each auger mine operation should have an adequate supply of first-aid equipment at strategic locations. The first-aid supplies should be encased in suitable sanitary receptacles, designed to be reasonably dusttight and moistureproof, and should be available to all persons employed at the mine. In addition to the material in the cases, splints, blankets, and properly constructed stretchers in good condition should be provided.

8.06 When an injury occurs, prompt medical attention should be provided; adequate facilities should be available for transporting injured persons to a hospital when necessary.

Supervision

8.07 Each auger mine operation should be supervised by a competent foreman, who should be responsible for the safety of the employees.

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